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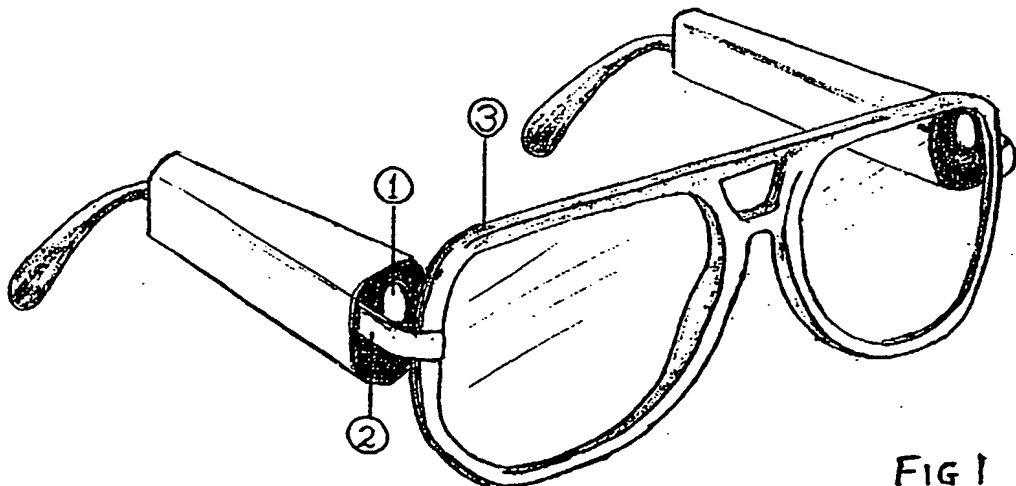
(56) Documents Cited

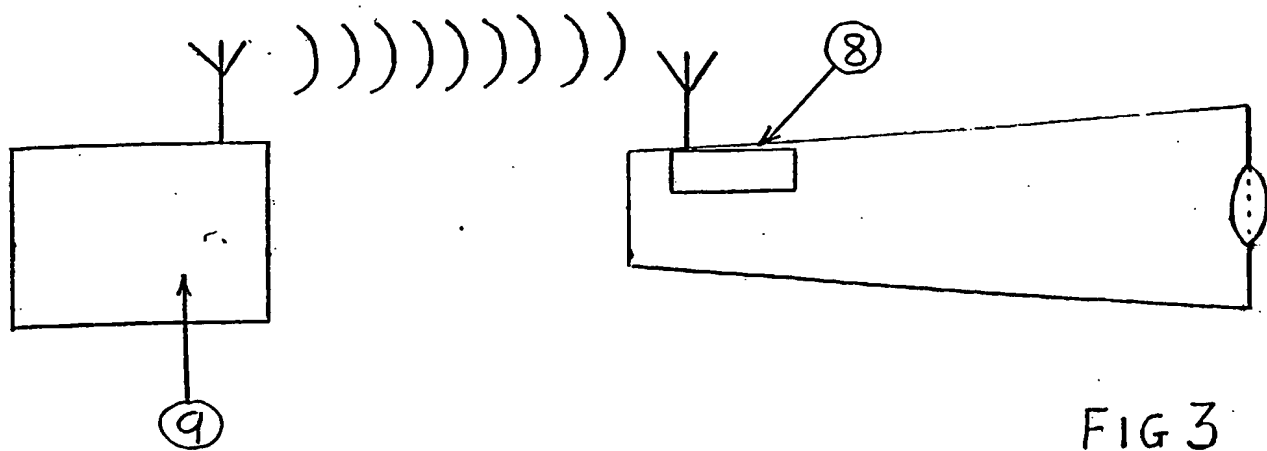
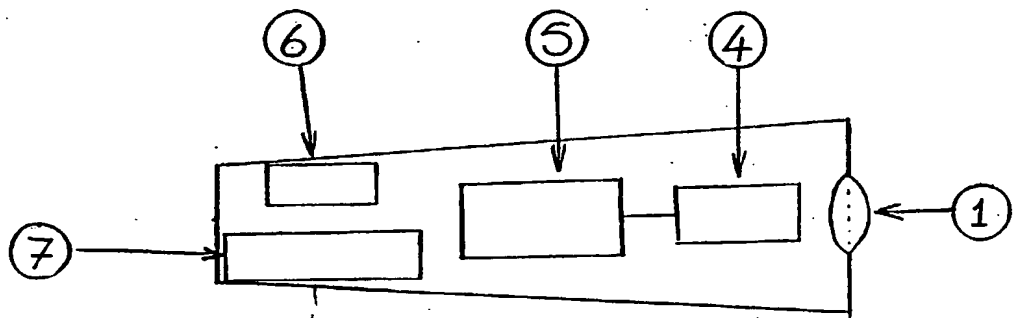
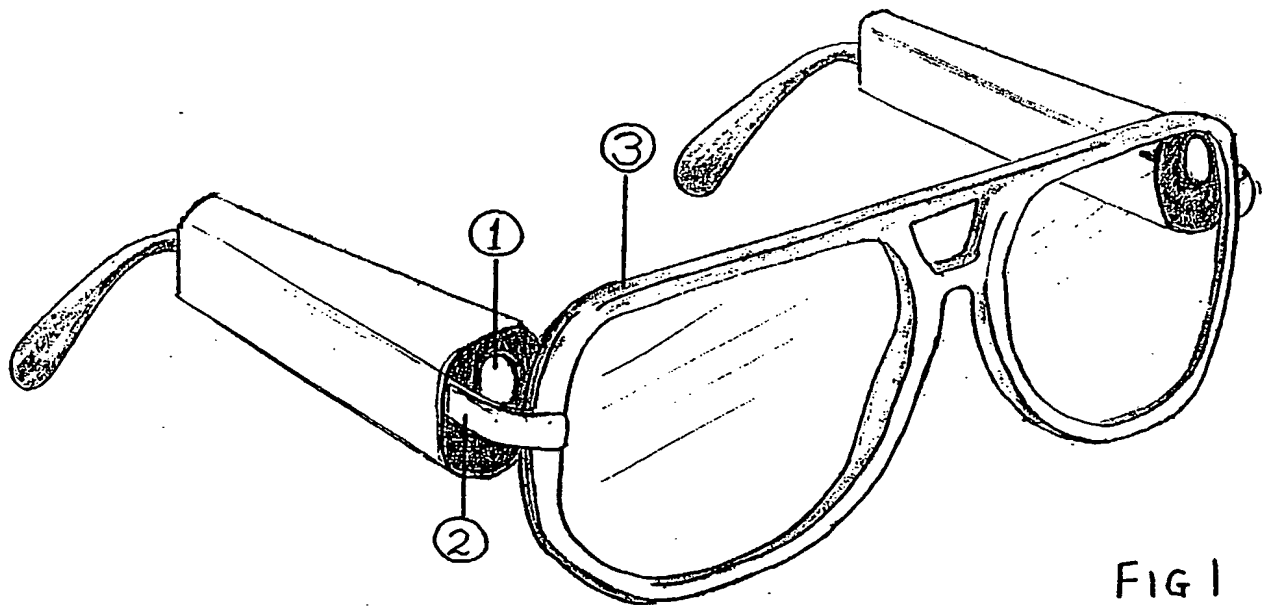
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(54) Abstract Title
Monitoring drowsiness

(57) An apparatus for monitoring the drowsiness of an operator of a vehicle or machine, includes a suitable sensor (1) positioned so as to view the eye of the wearer of said apparatus, a processor (4), memory chip (5), power source (6) and a warning device (7) connected so as to provide a warning in the event of the operator's drowsiness reaching an unacceptable level. Preferably the apparatus comprises either part of, or an attachment to a pair of spectacles. The warning device may be part of a remote device.





Title: Apparatus for monitoring the drowsiness of an operator of a vehicle or machine

Description:

The invention relates to an apparatus to be used by operators of a vehicle, or machine, for the purpose of monitoring levels of drowsiness and supplying a warning of excessive drowsiness through an emission of light, sound, or other warning device.

Such a warning device could be advantageous in preventing road traffic and industrial accidents caused by excessive operator fatigue resulting in sleep or near sleep drowsiness. The apparatus could be of use in any other field of work requiring extended periods of alertness, including the work of security guards and medical professionals.

Such monitoring and warning devices have previously been designed but have either been dependant upon monitoring the inclination of the vehicle/machine operator's head (such as US Patent No. 3,999,177, Greene, 1975), or have been composed of one or more fixtures within the vehicle operated. In particular US patent No. 6,304,187 (Pirim, 2001) describes a method of measuring the duration of blinking episodes to provide a measurement of the operator's level of drowsiness using a device mounted in the rear-view mirror of a car. These prior art approaches may fail to compensate for movement of the operator and in particular of the operator's head during operation of the vehicle/machine.

An object of the invention is to provide a means to monitor the level of drowsiness of the vehicle/machine operator, which compensates for movement of the operator and in particular their head.

Accordingly the device for monitoring the vehicle/machine operator should be moveable with the operator's body and /or head and not dependent upon the inclination of the head for monitoring the operator's drowsiness.

The apparatus should either be capable of recognising that the vehicle/machine operator has exceeded an acceptable level of drowsiness and supply a warning, or should transmit relevant data to a remote device capable of performing the same function.

In the embodiment here described the apparatus is to be worn on the head of the operator, either as an integral part of a pair of spectacles, or attachable to spectacles frame. In an alternative embodiment the apparatus could be mounted on a frame similar to that of spectacles, a headband, or hat of other fashion. The apparatus includes a CCD camera mounted so as to view the eyes of said vehicle/machine operator. This CCD camera could be exchanged for another light-, ultrasonic- or heat-sensitive device.

Figure 1 shows the preferred embodiment

Figure 2 shows an idealised representation of the components as arranged in the completed device.

Figure 3 shows an alternative embodiment

As shown in Figure 1 the CCD camera (1) is positioned at the articulating joint of the arm (2) and lens holding of a spectacles frame (3). The camera positioned in such a way as to view the open or closed nature of the eye, either directly or through a mirror mounted on the spectacles frame or through a semi-reflective coating applied to the inside of the spectacles lenses.

Figure 2 shows the connection of camera (1) to a processor (4). The processor to be capable of differentiating the light-reflective qualities, or temperature differential, or ultrasonic signature of the surface of the eye and/or the surface of the eyelid, thereby ascertaining the open or closed nature of the eye in real time, or close to real time, from the data supplied by the camera, or other suitable sensor. Figure 2 also shows the connection of the processor to a memory chip (5), with a connected power source (6). Said chip to be supplied with sufficient data to trigger the warning device (7) in the event of the eyes being closed for longer than a set period, or the eyelid movement fulfilling a prescribed pattern, thereby indicating an excessive level of drowsiness in the wearer.

In Figure 3 an alternate embodiment is shown in which the processor is connected to a transceiver (8) capable of transmitting the data concerning the open or closed nature of the eye to a remote device (9). Said remote device would trigger a warning system in the event of the eye's being closed for longer than a pre-set period of time, thereby indicating an excessive level of drowsiness in the vehicle/machine operator. In a further alternative embodiment the transceiver would be attached to the chip and would transmit a specific signal to a remote warning system.

This signal could either be part of a continual transmission of data, or a transmission commencing only when the apparatus detects an excessive level of drowsiness in the vehicle/machine operator.

It is also possible that a warning device could include such measures to improve vehicle safety as described in U.S. Patent No. 6,060,989), including "reducing speed of said vehicle [and] turning on a flasher signal"(Gehlot, 1998, Claim 9) when the apparatus has detected an excessive level of drowsiness in the operator.

In the preferred embodiment an on/off, or reset, button is connected to the power supply of the 'trigger' device. This allows the operator to turn the apparatus on and off: when starting and stopping operation of the vehicle or machinery; when taking off and putting on the apparatus; or following the activation of the warning device and subsequent to the arousal of the vehicle/machine operator and their completion of appropriate measures.

In an alternative embodiment, where the warning system is part of a remote device attached to the vehicle or machine operated, the on/off mechanism of said warning device could be dependant on the active state of, or power supply to, that vehicle or machine and could only be activated when the vehicle or machine was in use. In the above described embodiment a 'reset' button attached to the warning device, or that part of the apparatus worn by the operator, would be required to halt the action of the warning device and return it to a state in which it could be activated on the detection of a further episode of excessive drowsiness in the operator.

Claims:

1. An apparatus for continuous monitoring of a person's level of drowsiness and to trigger a warning device to prevent said person from falling asleep or reaching an excessive level of drowsiness including:

a CCD camera, light sensor, heat sensor, ultrasonic sensor or other suitable sensor device mounted so as to continuously view the eye and the area thereof of the user of said apparatus when said apparatus is in use;

said camera, or sensor providing a continuous or intermittent stream of information to an appropriate processor and memory chip, these being supplied with an appropriate power source;

said processor and memory chip being capable of processing said information stream from said camera, or sensor device into a data stream including data as to the present, and/or recent, open and/or closed nature of the eye;

said processor and memory chip being capable of providing a signal to an appropriate warning device and/or activating appropriate safety measures in the event of said data stream fulfilling a predetermined pattern indicative of drowsiness, excessive drowsiness, or a condition of sleep in the user of said apparatus.

2. An apparatus as claimed in Claim 1 mounted on, or attachable to and detachable from, or forming an integral part of the frame of a pair of spectacles, or a frame similar to that of a pair of spectacles, or a hat, or other form of head gear.
3. An apparatus as claimed in Claim 2 where said warning device is an integrated part of the apparatus.
4. An apparatus as claimed in Claim 2 where said warning device is, or part of, a remote device and said signal is transmitted from said processor and memory chip to said warning device via suitable transceivers.

5. An apparatus as claimed in Claim 2 where the memory chip and warning device are, or part of, a remote device and said processor transmits said data stream to said memory chip via suitable transceivers.
6. An apparatus as claimed in Claim 3 including an on/reset/off switch capable of activating the apparatus when required for use, deactivating the apparatus when not required for use and returning the apparatus to an active status in the event of the warning device being triggered.
7. An apparatus as claimed in Claim 4 including an on/off switch attached to that part of the apparatus worn by the user of said apparatus, allowing the apparatus to be placed in an active or inactive state as needed and a reset switch/button attached to the warning device, which is a remote device, allowing said warning device to be deactivated and returned to a ready state after an appropriate warning has been given and necessary action taken.
8. An apparatus as claimed in Claim 4 where the warning device, being a remote device, is only supplied with electrical power, or another suitable power supply when the vehicle, machine or other equipment operated by the user of said apparatus is in an active state and is substantially deactivated when said vehicle, machine or other equipment is not active.
9. An apparatus as claimed in Claim 5 including a reset switch/button attached to the warning device, which is a remote device, allowing said warning device to be deactivated and returned to a ready state after an appropriate warning has been given and necessary action taken.
10. An apparatus as claimed in Claim 5 where the warning device, being a remote device, is only supplied with electrical power, or another suitable power supply when the vehicle, machine or other equipment operated by the user of said apparatus is in an active state and is substantially deactivated when said vehicle, machine or other equipment is not active.
11. An apparatus as claimed in Claim 2 where a mirror, or other reflective and/or semi-reflective surface constitutes a part of said apparatus and is positioned so as to allow said CCD camera, light sensor, heat sensor, ultrasonic sensor, or other suitable sensor device to view the eye and the area thereof of the user of said apparatus.

12. An apparatus as claimed in Claim 2 where an appropriate housing contains, or forms an integral part of all or part of said apparatus
13. An apparatus substantially as herein described above and illustrated in the accompanying drawings.

Amendments to the claims have been filed as follows

7

Claims:

1. An apparatus for continuous monitoring of a person's level of drowsiness and to trigger a warning device to prevent said person from falling asleep or reaching an excessive level of drowsiness including:

a CCD camera mounted so as to continuously view the eye and the area thereof of the user of said apparatus when said apparatus is in use;

said camera providing a continuous or intermittent stream of information to an appropriate processor and memory chip, these being supplied with an appropriate power source;

said processor and memory chip being capable of processing said information stream from said camera, or sensor device into a data stream including data as to the present, and/or recent, open and/or closed nature of the eye;

said processor and memory chip being capable of providing a signal to an appropriate warning device and/or activating appropriate safety measures in the event of said data stream fulfilling a predetermined pattern indicative of drowsiness, excessive drowsiness, or a condition of sleep in the user of said apparatus.

2. An apparatus as claimed in Claim 1 mounted on, or attachable to and detachable from, or forming an integral part of the frame of a pair of spectacles, or a frame similar to that of a pair of spectacles, or a hat, or other form of head wear.
3. An apparatus as claimed in Claim 2 where said warning device is an integrated part of the apparatus.
4. An apparatus as claimed in Claim 2 where said warning device is, or part of, a remote device and said signal is transmitted from said processor and memory chip to said warning device via suitable transceivers.

5. An apparatus as claimed in Claim 2 where the memory chip and warning device are, or part of, a remote device and said processor transmits said data stream to said memory chip via suitable transceivers.
6. An apparatus as claimed in Claim 3 including an on/reset/off switch capable of activating the apparatus when required for use, deactivating the apparatus when not required for use and returning the apparatus to an active status in the event of the warning device being triggered.
7. An apparatus as claimed in Claim 4 including an on/off switch attached to that part of the apparatus worn by the user of said apparatus, allowing the apparatus to be placed in an active or inactive state as needed and a reset switch/button attached to the warning device, which is a remote device, allowing said warning device to be deactivated and returned to a ready state after an appropriate warning has been given and necessary action taken.
8. An apparatus as claimed in Claim 4 where the warning device, being a remote device, is only supplied with electrical power, or another suitable power supply when the vehicle, machine or other equipment operated by the user of said apparatus is in an active state and is substantially deactivated when said vehicle, machine or other equipment is not active.
9. An apparatus as claimed in Claim 5 including a reset switch/button attached to the warning device, which is a remote device, allowing said warning device to be deactivated and returned to a ready state after an appropriate warning has been given and necessary action taken.
10. An apparatus as claimed in Claim 5 where the warning device, being a remote device, is only supplied with electrical power, or another suitable power supply when the vehicle, machine or other equipment operated by the user of said apparatus is in an active state and is substantially deactivated when said vehicle, machine or other equipment is not active.
11. An apparatus as claimed in Claim 2 where a mirror, or other reflective and/or semi-reflective surface constitutes a part of said apparatus and is positioned so as to allow said CCD camera to view the eye and the area thereof of the user of said apparatus.
12. An apparatus as claimed in Claim 2 where an appropriate housing contains, or forms an integral part of all or part of said apparatus.

13. An apparatus substantially as herein described above and illustrated in the accompanying drawings.



INVESTOR IN PEOPLE

Application No: GB 0203392.6
Claims searched: 1 to 13

10

Examiner: Geoffrey Pitchman
Date of search: 24 September 2002

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): G1A(AMRP) G4N (NHSX NRX)

Int Cl (Ed.7): G08B 21/00

Other: ONLINE: EPODOC WPI JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2285681 A	(TERRY)-see whole document	1-3, 6, 12 at least
X	GB 2145262 A	(GUNSON'S COLORPLUGS)-see abstract, page 1 lines 86 to 107	1-3, 8 at least
X	GB 2129989 A	(CHEO SWEI WEN)-see whole document	1-3 at least
X	GB 2133598 A	(XANADU)-see whole document	1-3 at least
E, X	WO 02/25615 A1	(EYESWIDE)-see abstract and page 6 line 11 to page 7 line 11	1-3, 8 at least
X	WO 00/79499 A1	(PATERSON)-see abstract	1-3 at least
X	EP 0908860 A1	(DERIVADOS)-see abstract, paragraphs 0010 to 0016 and paragraphs 0040 to 0041	1-3 at least
X	EP 0280124 A1	(OMRON TATEISHI)-see column 13 line 34 to column 15 line 43	1-3 at least
X	US 5745038	(VANCE)-see whole document	1-3 at least
X	US 3863243	(SKOLNICK)-see whole document	1-3 at least

X Document indicating lack of novelty or inventive step
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